International Journal of Agricultural
Science and Research (IJASR)
ISSN(P): 2250-0057; ISSN(E): 2321-0087
Vol. 5, Issue 5, Oct 2015, 121-128
TJPRC Pvt. Ltd.

STUDIES ON PRESERVATION OF AONLA JUICE BY PRESERVATIVES AND THERMAL PROCESSING

RAJESH LATHER, S. S. SINDHU & SURESH KUMAR

Department of Horticulture, CCS Haryana Agricultural University, Hisar, Haryana, India

ABSTRACT

Aonla or Indian gooseberry (*Emblica officinalis* Gaertn.), belongs to family Euphorbiaceae, is one of the most important minor fruit. It is native of India, Malaya and China. In this experiment, the juice preserved with potassium metabisulphite @ 1.5 g/l was found most effective in minimizing the chemical changes in the juice during storage up to six months at room temperature. However, pasteurization also helped to maintain the juice in a better condition than control.

KEYWORDS: Aonla, Potassium Metabisulphite, Sodium Benzoate, Pasteurized

INTRODUCTION

Aonla or Indian gooseberry (*Emblica officinalis* Gaertn.), belongs to family Euphorbiaceae, is one of the most important minor fruit. Aonla is gaining popularity in India owing to hardy nature of the plant with low water requirement. Aonla is the richest source of vitamin C after Barbados cherry.

Owing to high astringency, blunt taste in aonla, it can be utilized for preparation of drinks and other beverages. In the recent past, there has been substantial increase in the area and production under aonla fruits. Many times, this results in seasonal gluts, which leads to the substantial reduction in the market price. Therefore, to ensure the aonla production and to avoid the seasonal glut in market, the processing of this fruit into various value added products having long storage life is necessary.

The Study was Carried Out with the Objective

- To standardize the method for preservation of aonla juice.

MATERIALS AND METHODS

Freshly harvested mature aonla fruits cv. Chakaiya were procured from departmental orchard of CCS Haryana Agricultural University, Hisar. The fruits of uniform size free from any injury, disease or bruising were selected. GR grade chemicals were used in investigation. Three replications of each treatment of different products were prepared and the prepared products were filled in bottles of 250 ml capacity and then stored at room temperature for subsequent analysis at monthly intervals.

Treatments

T_1: Aonla juice without preservative (control)

T_2: Aonla juice with potassium metabisulphite 1.0 g/l

T_3: Aonla juice with potassium metabisulphite 1.5 g/l

T_4: Aonla juice with sodium benzoate 1.0 g/l

T_5: Aonla juice with sodium benzoate 1.5 g/l

T_6: Pasteurized aonla juice (in bottle)

T_7: Sterilized bottles with pasteurized juice (over flow method)

Design: CRD

Replications: Three

Storage period: six months

Storage conditions: room temperature (20±5)

Cultivar: Chakaiya

Temperature: 100^0 C

RESULTS AND DISCUSSIONS

The present investigation entitled **"**studies on preservation of aonla juice by preservatives and thermal processing**"** was carried out in the Department of Horticulture, CCS HAU, Hisar, during the year 2005 and 2006. The results obtained are presented in this chapter under different headings:-

Changes in phsico-chemical composition of aonla products during storage

Changes in phsico-chemical composition of aonla juice by preservatives and thermal processing during storage at room temperature

Changes in Total Soluble Solids

The data relating to the total soluble solids as influenced by various preservatives and thermal processing up to six months of storage at room temperature has been presented in Table 1. The data indicates that the TSS content of aonla juice increased significantly from 8.16 per cent to 9.32 per cent with the increasing period of storage, when considered irrespective of the treatments, during the year 2005. Among the treatments, when the TSS was considered on mean basis, the minimum TSS (8.64 per cent) was recorded in juice preserved with potassium metabisulphite (1.5 g/l) followed by the juice preserved with potassium metabisulphite (1.0 g/l) in which 8.70

Table 1: Effect of different preservatives on total soluble solids (per cent) of aonla juice during storage at room temperature

	2005								2006							
	Period of Storage (Months)								Period of Storage (Months)							
Treatment	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**Mean**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**Mean**
Control	8.00	8.50	8.67	9.13	9.30	9.43	9.47	**8.93**	8.50	8.83	9.00	9.33	9.83	9.96	10.00	**9.35**

KMS @ 1g/l	8.00	8.33	8.50	8.67	9.00	9.17	9.25	**8.70**	8.50	8.67	8.83	9.00	9.17	9.33	9.55	**9.01**
KMS @ 1.5g/l	8.00	8.33	8.50	8.67	8.83	9.00	9.17	**8.64**	8.50	8.67	8.83	9.00	9.17	9.25	9.33	**8.96**
Sodium benzoate @1g/l	8.00	8.33	8.67	8.83	9.00	9.25	9.33	**8.77**	8.50	8.67	8.83	9.00	9.33	9.50	9.83	**9.09**
Sodium benzoate @1.5g/l	8.00	8.33	8.50	8.70	9.00	9.17	9.25	**8.71**	8.50	8.67	8.83	9.00	9.17	9.33	9.67	**9.02**
Pasteurization in bottle	8.47	8.67	8.83	9.00	9.17	9.25	9.33	**8.96**	9.00	9.20	9.35	9.52	9.70	9.78	9.83	**9.48**
Pasteurization (over flow method)	8.63	8.80	9.00	9.13	9.27	9.40	9.45	**9.10**	9.23	9.40	9.48	9.55	9.70	9.85	10.00	**9.60**
Mean	**8.16**	**8.47**	**8.67**	**8.87**	**9.08**	**9.24**	**9.32**		**8.68**	**8.87**	**9.02**	**9.20**	**9.44**	**9.57**	**9.74**	

C.D. at 5% level	2005	2006
Storage period	0.14	0.14
Treatment	0.14	0.13
Storage period x Treatment	N.S.	N.S.

Per cent TSS was observed after six months of storage. The maximum TSS (9.10 per cent) was observed in pasteurized juice with over flow method, irrespective of storage period. In the beginning, the thermal processed or pasteurized juice recorded higher TSS content as compared to juice preserved by chemicals or preservatives. The interaction of treatment with storage period was found non significant. . Increase in TSS content during storage can be attributed due to partial hydrolysis of polysaccharides like starch, hemi cellulose and pectic substances into simple soluble substances. Increase in total soluble solids was also reported in citrus juice (Mehta and Bajaj, 1983), in lime juice (Sharma and Singh, 2005), in grape juice (Alam –Zeb *et al.*, 2009).

The same pattern of significant increase in TSS with the increasing period of storage was observed during the year 2006. The minimum TSS (8.96 per cent) was recorded in juice preserved with potassium metabisulphite (1.5 g/l), whereas, the maximum TSS (9.60 per cent) was recorded in pasteurized juice with over flow method. Among various treatments, potassium metabisulphite 1.5 g/l was found most effective in minimizing the change in TSS.

Changes in Acidity

The data presented in Table 2 reveals the effect of different preservatives and thermal processing on acidity up to six months of storage at room temperature. The perusal of the data indicates that with the increase in storage period there was significant increase in acidity irrespective of treatments. Among the treatments, on

Table 2: Effect of different Preservatives on Acidity (Per Cent) of Aonla Juice during Storage at Room Temperature

	2005								2006							
	Period of storage (months)								Period of storage (months)							
Treatment	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**Mean**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**Mean**
Control	2.110	2.303	2.407	2.593	2.657	2.790	2.820	**2.526**	2.137	2.337	2.423	2.617	2.680	2.837	2.850	**2.554**
KMS @ 1g/l	2.110	2.280	2.393	2.570	2.613	2.767	2.783	**2.502**	2.137	2.313	2.409	2.593	2.637	2.804	2.823	**2.531**
KMS @ 1.5g/l	2.110	2.270	2.387	2.560	2.607	2.757	2.773	**2.495**	2.137	2.301	2.402	2.580	2.630	2.803	2.812	**2.524**
Sodium benzoate @1g/l	2.110	2.290	2.400	2.577	2.627	2.777	2.795	**2.511**	2.137	2.317	2.427	2.604	2.654	2.810	2.839	**2.541**
Sodium benzoate @1.5g/l	2.110	2.283	2.397	2.573	2.623	2.773	2.790	**2.507**	2.137	2.307	2.413	2.600	2.650	2.806	2.832	**2.535**
Pasteurization in bottle	2.357	2.400	2.463	2.500	2.553	2.603	2.653	**2.504**	2.382	2.433	2.496	2.539	2.583	2.630	2.681	**2.534**
Pasteurization (over flow method)	2.370	2.415	2.464	2.494	2.539	2.580	2.639	**2.500**	2.403	2.443	2.494	2.528	2.563	2.612	2.660	**2.529**
Mean	**2.182**	**2.320**	**2.416**	**2.552**	**2.603**	**2.721**	**2.750**		**2.210**	**2.350**	**2.438**	**2.580**	**2.628**	**2.757**	**2.785**	

C.D. at 5% Level	2005	2006
Storage period	0.005	0.004
Treatment	0.005	0.004
Storage period x Treatment	0.012	0.011

Mean basis, the minimum acidity (2.495 per cent) was recorded in juice preserved with potassium metabisulphite (1.5 g/l) followed by the pasteurized juice with over flow method where 2.500 per cent acidity was observed. The maximum acidity (2.526 per cent) was recorded in control when acidity was considered irrespective of storage period. The pasteurized juice recorded higher acidity content in the beginning of storage and increased with the increasing period of storage. The increase in acidity might be due to degradation of pectic substances or due to the formation of organic acids by ascorbic acid degradation and also due to breakdown of polysacchrides into simple sugars and their immediate conversion into acids for entry into TCA cycle as reported by Garg and Goel (2006) in aonla ciderThe same trend was noticed during the year 2006. The acidity content increased significantly with the increasing period of storage. The minimum acidity (2.524 per cent) was recorded in juice preserved with potassium metabisulphite (1.5 g/l) followed by 2.529 per cent in pasteurized juice with over flow method and the maximum acidity (2.554 per cent) was observed in control.

Changes in Total Sugars

The data pertaining to the effect of different preservatives and thermal processing on the total sugars content of aonla juice up to six months of storage at room temperature has been furnished in Table 3.

It is evident from the data that total sugars content in the beginning was minimum (6.42 per cent) which increased continuously with increase in storage period and reached to maximum (6.66 per cent) up to six months of storage, irrespective of treatments during the year 2005. . This increase in total sugars content might be due to the degradation of insoluble polysacchrides like hemi cellulose and oligosacchrides into simple sugars (Kalra *et al.*, 1985) and also due to the conversion of acids into sugars. Same increase in total sugars during storage at room temperature was also reported by Tripathi *et al.* (1988) in aonla juice The same pattern of non- significant increase was noticed during the year 2006 where total sugars content increased from 6.44 per cent to 6.67 per cent up to six months of storage. However, the total sugars content of the aonla juice was not significantly affected by the treatments, period of storage and interaction of treatments with

storage period, during the year 2005 and 2006.

Table 3: Effect of different Preservatives on Total Sugars (per cent) of Aonla Juice during Storage at Room Temperature

	2005								2006							
	Period of Storage (Months)								Period of Storage (Months)							
Treatment	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**Mean**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**Mean**
Control	6.42	6.45	6.50	6.56	6.63	6.69	6.75	**6.57**	6.44	6.48	6.53	6.58	6.66	6.73	6.79	**6.60**
KMS @ 1g/l	6.42	6.43	6.46	6.51	6.57	6.62	6.67	**6.52**	6.44	6.45	6.48	6.52	6.58	6.64	6.69	**6.53**
KMS @ 1.5g/l	6.42	6.43	6.45	6.48	6.53	6.57	6.61	**6.50**	6.44	6.44	6.46	6.49	6.54	6.59	6.63	**6.51**
Sodium benzoate @1g/l	6.42	6.45	6.48	6.53	6.59	6.64	6.69	**6.54**	6.44	6.47	6.50	6.54	6.60	6.66	6.71	**6.56**
Sodium benzoate @1.5g/l	6.42	6.43	6.46	6.52	6.57	6.62	6.66	**6.53**	6.44	6.45	6.48	6.52	6.58	6.64	6.68	**6.54**
Pasteurization in bottle	6.43	6.44	6.45	6.49	6.53	6.57	6.61	**6.51**	6.45	6.46	6.47	6.50	6.54	6.58	6.62	**6.52**
Pasteurization (over flow method)	6.44	6.44	6.45	6.48	6.52	6.56	6.60	**6.50**	6.46	6.46	6.47	6.49	6.53	6.57	6.60	**6.51**
Mean	**6.42**	**6.44**	**6.46**	**6.51**	**6.56**	**6.61**	**6.66**		**6.44**	**6.46**	**6.48**	**6.52**	**6.58**	**6.63**	**6.67**	

C.D. at 5% Level	2005	2006
Storage period	N.S	N.S.
Treatment	N.S.	N.S.
Storage period x Treatment	N.S.	N.S.

Changes in Ascorbic Acid

The data pertaining to the effect of different preservatives and thermal processing on ascorbic acid content of aonla juice up to six months of storage at room temperature has been furnished in Table 4.

The perusal of the data indicates that there was significant decrease in ascorbic acid content of aonla juice with the increasing period of storage. In the beginning, the ascorbic acid content was 358.7 mg/100 ml and decreased to 260.2 mg/100 ml up to six months of storage, irrespective of the treatments, during the year 2005. Among the treatments, when ascorbic acid was considered on mean basis, the maximum retention in ascorbic acid content (321.8 mg/100 ml) was recorded in

Table 4: Effect of different Preservatives on Ascorbic Acid (mg/100 ml) of Aonla Juice during Storage at Room Temperature

	2005								2006							
	Period of storage (months)								Period of storage (months)							
Treatment	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**Mean**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**Mean**
Control	364.0	348.2	330.3	302.7	268.0	248.5	228.3	**298.6**	371.0	353.6	335.3	307.7	272.0	252.3	233.3	**303.6**
KMS @ 1g/l	364.0	348.0	338.7	313.3	286.3	268.0	256.7	**310.7**	371.0	355.2	344.7	318.3	290.3	272.8	261.7	**316.3**
KMS @ 1.5g/l	364.0	350.5	341.7	325.7	304.0	287.4	279.0	**321.8**	370.7	358.0	347.7	330.7	309.0	295.2	285.0	**328.0**
Sodium benzoate @1g/l	365.0	345.2	335.0	309.0	282.0	266.9	251.0	**307.7**	372.0	352.4	341.0	314.0	286.0	269.9	256.0	**313.0**
Sodium benzoate @1.5g/l	364.0	349.0	338.7	317.0	291.3	279.2	268.3	**315.4**	371.0	356.6	344.7	322.0	295.3	283.4	273.0	**320.9**
Pasteurization in bottle	350.7	343.4	335.7	320.3	300.2	286.3	270.7	**315.1**	357.7	350.5	341.7	325.3	304.7	290.6	275.0	**320.8**
Pasteurization (over flow method)	339.0	333.3	327.8	314.7	296.8	282.0	267.5	**308.7**	346.0	340.2	332.7	318.7	298.3	286.6	272.0	**313.5**
Mean	**358.7**	**345.4**	**335.4**	**314.7**	**289.9**	**274.0**	**260.2**		**365.6**	**352.4**	**341.1**	**319.5**	**293.7**	**278.7**	**265.1**	

C.D. at 5% Level	2005	2006
Storage period	8.41	8.42
Treatment	8.41	8.42
Storage period x Treatment	10.73	10.75

Juice preserved with potassium metabisulphite (1.5 g/l) followed by juice preserved with sodium benzoate (1.5 g/l) where 315.4 mg/100 ml ascorbic acid was observed which was at par with the juice pasteurized in bottle. Minimum retention in ascorbic acid content (298.6 mg/100 ml) was recorded in control when considered irrespective of the storage period. In the beginning of storage period, comparatively less ascorbic acid was recorded in pasteurized juice as compared to chemically preserved juice which further decreased with the increase in storage period. The decline in ascorbic acid content during storage might be attributed due to its degradation into other substances and also due to thermal oxidation during processing and subsequent oxidation with entrapped air in bottle during storage. The same decreasing trend of ascorbic acid content during storage at room temperature was reported in aonla juice by Tripathi *et al.* (1988).

The same pattern of significant decrease in ascorbic acid content during storage period was noticed during the year 2006. The ascorbic acid content of the juice decreased from 365.6 mg/100 ml to 265.1 mg/100 ml during six months of storage, irrespective of the treatments. Among the treatments, on mean basis, the maximum retention in ascorbic acid content (328.0 mg/100 ml) was recorded in juice preserved with potassium metabisulphite (1.5 g/l) followed by juice preserved with sodium benzoate (1.5 g/l) in which 320.9 mg/100 ml ascorbic acid was observed which was at par in the juice pasteurized in bottle. Minimum retention in ascorbic acid content (303.6 mg/100 ml) was recorded in control when considered irrespective of the storage period. The treatment where potassium metabisulphite@ 1.5 g/l was used to preserve the juice was found most effective in maintaining the ascorbic acid content of the juice, during storage up to six months.

Organoleptic Rating

The data relating to the effect of different preservatives and thermal processing on the organoleptic rating of aonla juice up to six months of storage at room temperature has been furnished in Table 5.

Table 5: Effect of different preservatives on organoleptic Rating of Aonla Juice during storage at Room Temperature

	2005								2006							
	Period of Storage (Months)								Period of Storage (Months)							
Treatment	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**Mean**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**Mean**
Control	6.50	6.00	5.40	4.20	3.00	2.20	2.20	**4.21**	6.60	6.10	5.50	4.30	3.10	2.50	2.00	**4.30**
KMS @ 1g/l	6.50	6.40	6.00	5.60	5.20	4.80	4.30	**5.54**	6.70	6.60	6.20	5.80	5.40	5.00	4.50	**5.74**
KMS @ 1.5g/l	6.50	6.50	6.30	6.00	5.70	5.40	5.20	**5.94**	6.70	6.60	6.50	6.20	5.90	5.60	5.40	**6.13**
Sodium benzoate @1g/l	6.50	6.20	5.70	5.20	4.80	4.30	4.00	**5.24**	6.60	6.30	5.80	5.30	4.90	4.40	4.10	**5.34**
Sodium benzoate @1.5g/l	6.50	6.30	5.90	5.50	5.10	4.60	4.20	**5.44**	6.60	6.40	6.00	5.60	5.20	4.70	4.30	**5.54**
Pasteurization in bottle	6.70	6.70	6.50	6.20	6.00	5.60	5.40	**6.16**	6.80	6.70	6.60	6.30	6.10	5.70	5.50	**6.24**
Pasteurization (over flow method)	6.70	6.70	6.60	6.30	6.20	5.70	5.40	**6.23**	6.80	6.70	6.70	6.40	6.30	5.80	5.50	**6.31**
Mean	**6.56**	**6.40**	**6.06**	**5.57**	**5.14**	**4.66**	**4.39**		**6.69**	**6.49**	**6.19**	**5.70**	**5.27**	**4.81**	**4.47**	

The data reveals that as the storage period increased, the organoleptic score of aonla juice decreased from 6.56 to 4.39, irrespective of the treatments. Among the treatments, on mean basis, the maximum organoleptic score (6.23) was recorded in the juice which was pasteurized with over flow method followed by the juice pasteurized in bottle in which 6.16 score was observed. Minimum organoleptic score (4.21) was recorded in control where juice was stored without using any preservative, irrespective of the storage period. The organoleptic score was maximum in the beginning of the storage where juice was pasteurized and which decreased with the increasing period of storage. The loss in organoleptic quality or storage stability of the product after certain period is obvious. Temperature plays an important role in inducing certain biochemical changes in the product which leads to the formation of off- flavour and discolouration and thus masking the original flavour and colour of the product. The same trend of decrease in organoleptic score of grape juice was recorded during storage by Alam-zeb *et al.* (2009)

The same pattern of decrease in organoleptic score of aonla juice as the storage period increased was recorded during the year 2006. The organoleptic score decreased from 6.69 to 4.47 during storage period, irrespective of the treatments. Among the treatments, on mean basis, maximum score (6.31) was recorded where juice was pasteurized with over flow method followed by juice pasteurized in bottle in which 6.24 organoleptic score was observed. Minimum score (4.30) was recorded in control where juice was stored without any preservative.

CONCLUSIONS

The minimum change in TSS was recorded in the juice preserved with potassium metabisulphite @ 1.5 g/l followed by in pasteurized juice. In the beginning of storage period, the TSS was increased in pasteurized juice might be due to thermal processing. The maximum acidity was observed in juice which was stored without any preservative (control), whereas, the minimum acidity was recorded in juice preserved with potassium metabisulphite @ 1.5 g/l followed by in pasteurized juice with over flow method. Total sugars of juice was not significantly affected by the treatments, period of storage and interaction of treatments with period of storage. The ascorbic acid content of the juice decreased significantly during six month of storage, irrespective of all the treatments. The maximum retention of ascorbic acid was recorded in juice preserved with potassium metabisulphite @ 1.5 g/l, whereas, minimum ascorbic acid content was recorded in juice stored without any preservative (control). During the initial period of storage, the organoleptic score was not satisfactory because of astringent taste of juice. Maximum score was recorded in pasteurized juice and minimum in untreated juice up to six months of storage.

REFERENCES

1. Alam, Zeb, Ihsan, Anwar Ahmad, Khurshid Ali and Mohammad Ayub (2009). Grape juice preservation with benzoate and sorbate. *Advances in food sciences.* **31(1)**:17-21.
2. Garg, Neelam and Noopur Goel (2006). Development of aonla cider. *Indian Food Packer.* **pp.** 64-72.
3. Kalra, S.K. and D.K. Tandon (1985). Phsico-chemical changes in mango pulp during ambient storage in glass containers. *J.Food Sci. Technol.* **22:** 350

4. Mehta, V. and S. Bajaj (1983). Effects of storage and methods of preservation on the physico-chemical characteristics of citrus juices. *Ind. Fd. Packer.* **37**: 42-51.

5. Sharma, A. and Kartar Singh (2005). Effect of different treatments on TSS, sugars, viscocity and suspended pulp of lime juice during storage. *Haryana J. of Hort. Sci.* **34 (1-2):** 45-46.

6. Tripathi, V.K., M.B. Singh and S. Singh (1988). Studies on compositional changes in different preserved products of amla (*Emblica officinalis* Gaertn.) var. Banarasi. *Indian Food Packer.* **42 (4):** 60-66.